Superfund Technical Assessment and Response Team

El Dorado Hills
Naturally Occurring Asbestos
Multimedia Exposure Assessment
El Dorado Hills, California

Quality Assurance Project Plan
FINAL

Contract No.: 68-W-01-012
TDD No.: 09-04-01-0011
Job No.: 001275.0440.01CP

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Prepared for:
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Region 9

Prepared by:
Ecology and Environment, Inc.

Superfund Technical Assessment and Response Team

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Individual	Organization	Title	Date	Revision
Jere Johnson	U.S. EPA	Task Monitor	9/04	0
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Karen Ladd	START	Project Manager	9/04	0
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List of Acronyms and Abbreviations

AHERA	Asbestos Hazard Emergency Response Act
ASTM	American Society for Testing and Materials
cc	cubic centimeter
CARB	California Air Resources Board
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CoEMD	El Dorado County Environmental Management Department
DQO	Data Quality Objective
DQI	Data Quality Indicator
DTSC	California Department of Toxic Substances Control
E & E	Ecology and Environment, Inc.
ERT	Emergency Response Team
f/cc	fibers per cubic centimeter
FSP	Field Sampling Plan
GIS	geographical information system
GLP	good laboratory practices
GPS	global positioning system
HSP	Health and Safety Plan
ISO	International Organization for Standardization
:m	micrometer or micron
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standard and Technology
NVLAP	National Voluntary Laboratory Accreditation Program
PE	performance evaluation
PCM	phase contrast microscopy
PCME	phase contrast microscopy equivalents
PDA	personal digital assistant

Acronyms and Abbreviations (Cont.)

PLM	polarized light microscopy
PPE	personal protective equipment
QA	quality assurance
QAO	Quality Assurance Office
QAPP	Quality Assurance Project Plan
QC	quality control
QMP	Quality Management Plan
RPD	relative percent difference
s/cc	structures per cubic centimeter
SOP	standard operating procedure
SOW	scope of work
START	Superfund Technical Assessment and Response Team
TEM	transmission electron microscopy
USCS	Unified Soil Classification System
U.S. EPA	U.S. Environmental Protection Agency

Definitions

activity-based air sampling: Collecting air samples while engaging in dust generation activities (e.g., those that could disturb asbestos fibers and release them into the air).

ambient air: Generally, the surrounding air present throughout a vicinity. For the El Dorado Hills Naturally Occurring Asbestos Multimedia Exposure Assessment, ambient air is specifically defined as outdoor air (as opposed to indoor air) collected from the general vicinity of the various subject sites, and which may be used for reference samples. These samples may variably be upwind, downwind, or crosswind from locations that activity-based sampling scenarios are conducted, and they may or may not be influenced by sampling activities. In addition, some of the ambient air samples will be collected under normal conditions (i.e., while no activity-based sampling is conducted).

amphibole: One of the two groups of minerals (serpentine and amphibole) that can crystallize as asbestos. The regulated asbestiform minerals of this group are crocidolite, amosite, anthophyllite asbestos, tremolite asbestos, and actinolite asbestos.

asbestos: Asbestos is the generic name used for a group of naturally occurring mineral silicate fibers of the serpentine and amphibole series. Asbestos is composed of fiber bundles that are made up of extremely long and thin fibers that are easily separated from one another. For the purposes of this project, asbestos encompasses not only the six regulated varieties, but also the non-regulated asbestiform minerals.

asbestiform: Fibrous or tending to break into fibers.

aspect ratio: Length to width ratio.

breathing height: A height representing a typical height of a person's nose/mouth area.

Definitions (Cont.)

chrysotile: A regulated mineral in the serpentine group of minerals that can crystallize as asbestos. Chrysotile is also known as serpentine asbestos.

fixed sample pump: An air sample pump whose position is constant throughout the entire duration of the sampling effort. A fixed sample pump remains in its fixed location on a long-term basis over a period longer than 1 day. Typically a high-flow sample pump will be used where a fixed sample pump is needed.

high-flow sample pump: Also known as a high-volume sample pump, this is an air sample pump that is capable of drawing up to about 30 liters per minute of air. This type of sample pump is not generally portable and is typically used for sampling from fixed and stationary positions.

levels of personal protection: When sampling is conducted where contamination may exist, personal protective equipment (PPE) must be worn to prevent or reduce skin and eye contact, inhalation, and ingestion of the substance. Protective equipment to protect the body against contact with known or anticipated chemical hazards has been divided into four categories known as Levels A, B, C, and D:

- **Level D** is primarily a work uniform and is used for nuisance contamination only. Level D generally includes basic work clothing with steel-toed and steel-shanked boots, and may include coveralls, a hard hat, gloves, ear plugs, and safety goggles.
- **Level C** protection is worn when the type of airborne substance is known, concentration measured, criteria for using air-purifying respirators (APR) met, and skin and eye exposure is unlikely. Level C generally includes everything used for Level D, with the addition of an APR or powered APR for inhalation protection.
- **Level B** protection is worn when the highest level of respiratory protection is needed, but a lesser level of skin and eye protection. Level B also generally includes everything used for Level D; and in addition includes appropriate chemical-resistant coveralls and gloves for dermal protection, and a full-faced mask and self-contained breathing apparatus (SCBA) or supplied air for eye protection and complete respiratory protection.
- **Level A** protection is worn when the highest level of respiratory, skin, eye and mucous membrane protection is needed. Level A protection includes a fully encapsulated suit for total skin, eye and mucous membrane protection and an SCBA for complete respiratory protection.

naturally occurring asbestos: Asbestos minerals that occur in rock and soil as the result of natural geologic processes, often in veins near earthquake faults in the coast ranges and the foothills of the Sierra Nevada mountains and other areas of California.

personal sample pump: Also known as a low-flow or low-volume sample pump, this is an air sample pump that is portable so that it can be worn by a member of the sampling team during activity-based sample collection. The air flow for a personal sample pump is typically 1 to 5 liters per minute.

phase contrast microscopy (PCM): A light-enhancing microscope technology that employs an optical mechanism to translate small variations in phase into corresponding changes in amplitude, resulting in high-contrast images. This method was used traditionally to measure airborne fibers in occupational environments; however, it cannot distinguish between asbestos fibers and other fibers.

phase contrast microscopy equivalent (PCME): This refers to asbestiform structures identified through transmission electron microscopy (TEM) analysis that are equivalent to those that would be identified in the same sample through phase contrast microscopy analysis, with the main difference being that TEM additionally permits the specific identification of asbestos fibers. PCME structures are asbestiform structures greater than 5 microns in length having at least a 3 to 1 length to width (aspect) ratio.

polarized light microscopy (PLM): A microscope technology that uses the polarity (or orientation) of light waves to provide better images than a standard optical microscope.

reference sample: An ambient air sample from outside the specific area of concern collected concurrently with the activity-based samples; it is used as a reference for comparison with the activity-based air samples.

stationary sample pump: An air sample pump that is placed in a single location and is not moved during a sampling event. A stationary sample pump remains in its stationary location during one or more sample events. Typically a high-flow sample pump will be used where a stationary sample pump is needed.

Definitions (Cont.)

transmission electron microscopy (TEM): A microscope technology that uses the properties of electrons to provide more detailed images than even polarized light microscopy.

ultramafic rock: An igneous rock containing mainly dark, ferromagnesian minerals (i.e., greater than 90% of olivine, pyroxene, or hornblende). Commercial deposits of asbestos have been associated with ultramafic rocks.

Preface

This document presents the Quality Assurance Project Plan (QAPP) for the El Dorado Hills Naturally Occurring Asbestos Multimedia Exposure Assessment. The elements of this QAPP are in accordance with the U.S. EPA documents *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5, March 2001, EPA/240/B-01/003), *Guidance for the Data Quality Objectives Process* (EPA QA/G-4, August 2000, EPA/600/R-96/055) and *Guidance on Choosing a Sampling Design for Environmental Data Collection* (EPA QA/G-5S, December 2002, EPA/240/R-02/005).

This QAPP describes the quality assurance and quality control structure and the systematic quality control process that guide the planning, implementation, and assessment of this data collection effort. The Data Quality Objectives (DQOs) for the El Dorado Hills Naturally Occurring Asbestos Multimedia Exposure Assessment are in Appendix A. Other support documents submitted as appendices include task-specific field sampling plans (FSPs) (Appendix B), which present sampling design and analysis details; a Health and Safety Plan (HSP) (Appendix C) that addresses health and safety protocols for the task-specific field sampling; standard operating procedures (SOPs) (Appendix D); analytical scopes of work (SOWs) (Appendix E), and Reference Levels and Analytical Sensitivity (Appendix F).

The United States Environmental Protection Agency (U.S. EPA) has directed Ecology and Environment, Inc.'s (E & E's) Superfund Technical Assessment and Response Team (START) to conduct a multimedia exposure assessment of community areas and schools in El Dorado Hills in California to assess the potential for exposure from naturally occurring asbestos present in soils that have been disturbed.

This QAPP describes the project and data use objectives, data collection rationale, quality assurance goals, and requirements for sampling and analysis activities. It also defines the sampling and data collection methods that will be used for this project.

1 Project Management

1.1 Project and Task Organization

The overall project organization is presented in Figure 1-1, which graphically shows the functional organization structure and lines of communication for this project. E & E is the START contractor working under the direction of the U.S. EPA in support of the U.S. EPA's El Dorado Hills Naturally Occurring Asbestos Multimedia Exposure Assessment.

The roles and responsibilities and distinct assignments of the U.S. EPA and START members for this investigation are the following:

- Jere Johnson, U.S. EPA Task Monitor, will be the primary decision-maker and will direct the project, specify tasks, and ensure that the project is proceeding on schedule and is within budget. Additional duties include coordination of all preliminary and final reporting from and communication with the START Project Manager.

- Arnold Den, U.S. EPA Senior Technical Advisor, will provide technical direction to the U.S. EPA Task Monitor.

- Gerald Hiatt, Ph.D., U.S. EPA Senior Risk Assessor, will coordinate and provide technical direction to the U.S. EPA Task Monitor during objective, sampling, and analysis planning.

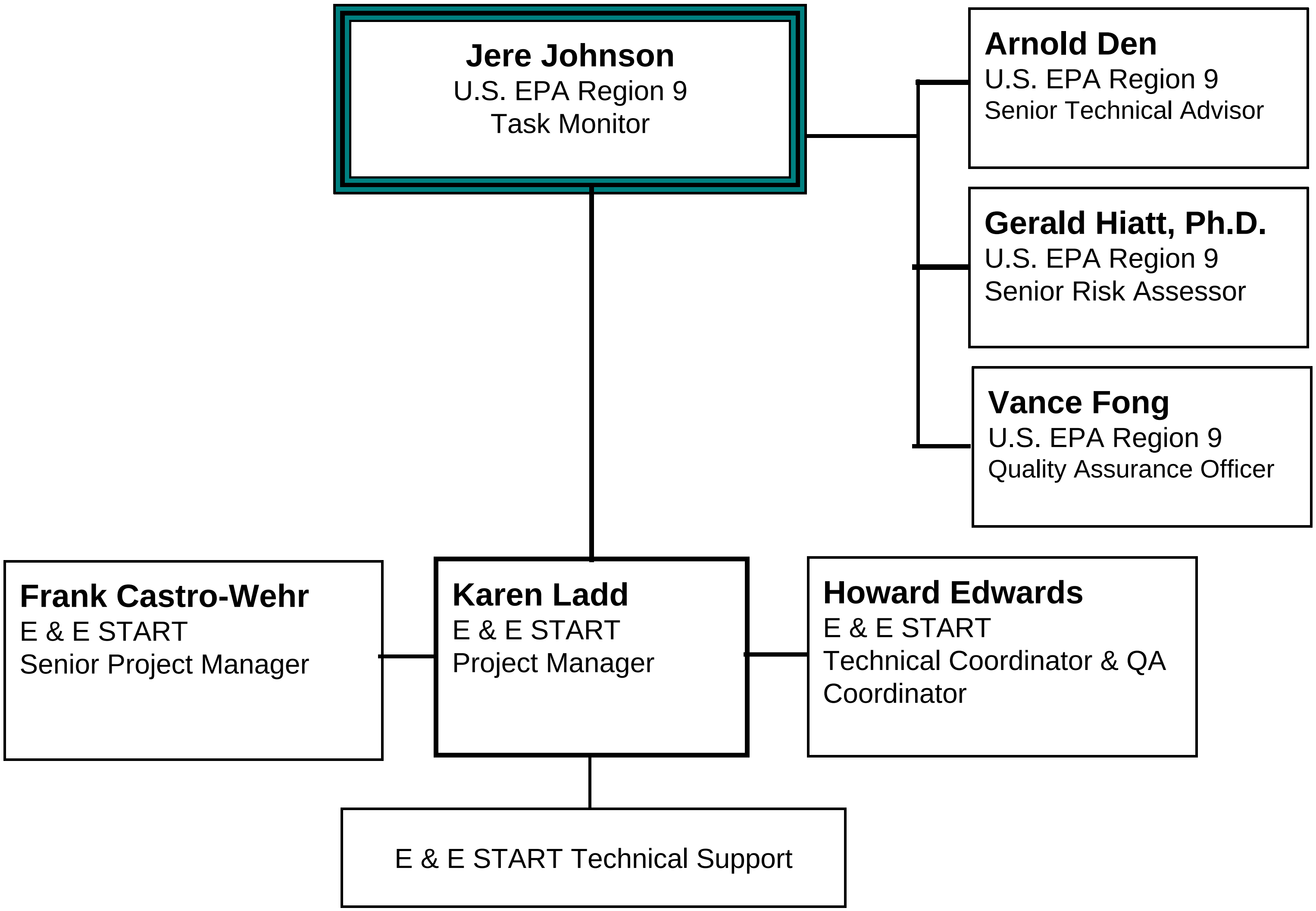
- Vance Fong, U.S. EPA Region 9 Quality Assurance (QA) Officer, (or designee) will provide independent quality assurance oversight to ensure that planning and plan implementation are in accordance with U.S. EPA regional quality assurance/quality control (QA/QC) protocol. He will provide technical direction concerning QA/QC as needed to the U.S. EPA Task Monitor.

- Frank Castro-Wehr, START Senior Project Manager, will oversee the preparation of the quality assurance project plan (QAPP), field sampling plans (FSPs) and other START deliverables. He will oversee START's implementation of the QAPP and FSPs. He will provide overall project quality assurance and, if necessary, audit functions.

- Karen Ladd, START Project Manager, will oversee all the project tasks, coordinate field sampling and scenarios, and ensure that each task is proceeding on schedule and is within budget. Additional duties include coordination and completion of all preliminary and final reporting to the U.S. EPA Task Monitor.

- Howard Edwards, START Project Technical Coordinator and Project QA Coordinator, will coordinate the preparation of the QAPP and FSPs. He will oversee air sample collection, and he will provide overall project and field technical assistance and QA coordination as needed.

Figure 1-1: Organization Structure



- Additional START technical support staff members will provide support services as needed for sampling, sampling coordination; data review and validation, data interpretation and management; risk-level comparison; and community involvement.

Laboratory services addressed in this plan will be subcontracted by E & E, and their performance will be monitored by START and U.S. EPA QA personnel. The subcontracted laboratories will follow project-specific analytical SOWs. The data will be validated by a subcontractor to E & E, with oversight by the U.S. EPA Quality Assurance Office (QAO).

1.2 Problem Definition and Background

1.2.1 Statement of Specific Problem

Naturally occurring asbestos is found in ultramafic rock formations in many locations in El Dorado County, California. In El Dorado Hills, the location of this assessment, asbestos is found in association with the West Bear Mountains Fault Zone, which runs north to south across El Dorado County. In El Dorado Hills the presence of asbestos in exposed soil and ambient air has already been documented through previous investigations as well as visual inspection conducted by the U.S. EPA, the California Department of Toxic Substances Control (DTSC), the California Air Resources Board (CARB), and the El Dorado Union High School District. These previous investigations were conducted in a residential area on Woedee Drive and at Oak Ridge High School, located at 1120 Harvard Way. Mitigation activities to address asbestos contamination in disturbed soils on the campus of Oak Ridge High School have been conducted by El Dorado Union High School District, with oversight by El Dorado County and the state, and by U.S. EPA.

In September 2003, a citizen petitioned U.S. EPA to conduct a preliminary assessment at the El Dorado Hills Community Park, Silva Valley Elementary School, Rolling Hills Middle School, and other locations in the community where the suspected presence of naturally occurring asbestos in exposed and disturbed soil may be causing releases to air. After review of the petition and discussions with the petitioner, the U.S. EPA defined the study area (called El Dorado Hills Naturally Occurring Asbestos) to include the El Dorado Hills Community Park, Silva Valley Elementary School, Rolling Hills Middle School, Jackson Elementary School, and the New York Creek Nature Trail.

1.2.2 Location and Description

El Dorado Hills is approximately 20 miles east of Sacramento, California. The community is within an unincorporated area of El Dorado County that is commonly referred to as the Western County Region. A number of areas throughout El Dorado Hills are the subject of the El Dorado Hills Naturally Occurring Asbestos Multimedia Exposure Assessment and are shown on Figure 1-2: Sites Location Map:

- The El Dorado Hills Community Park, including several play areas and the New York Creek Nature Trail;

- Silva Valley Elementary School;

- Jackson Elementary School;

Figure 1-2 SLIP SHEET
{Site Location Map}

- Rolling Hills Middle School, including the dirt embankment inside the school's eastern boundary (Dirt Embankment); and

- An unpaved lot used for parking on public property adjacent to and in front of Rolling Hills Middle School (Dirt Parking Area).

The El Dorado Hills Community Park at 1021 Harvard Way is situated on about 40 acres of property along El Dorado Hills Boulevard between Harvard Way and St. Andrews Drive (Latitude 38° 40' 59" North, Longitude 121° 04' 28" West). The Community Park property, which is transected by New York Creek, contains three baseball diamonds, soccer playing fields, a children's playground, a swimming pool, community center structures, the southern end of the New York Creek Nature Trail, other picnic and recreational areas, and parking areas. The New York Creek Nature Trail is an unpaved trail adjacent to New York Creek. From Harvard Way, the trail runs north almost 2 miles through the Community Park property and residential neighborhoods to Art Weisberg Park, which is opposite Jackson Elementary School on Francisco Drive.

Silva Valley Elementary School is located at 3001 Golden Eagle Lane (Latitude 38° 40' 40" North, Longitude 121° 04' 11" West). With over 700 students, it is a year-round K-5 elementary school in the Buckeye Union School District. Some of the school's facilities include six classroom buildings, a multipurpose room, an administration building, a library, a computer laboratory, a grass-covered playing field, a grass-infield baseball diamond, a "Life Lab" garden area, and play structures.

Jackson Elementary School is located at 2561 Francisco Drive (Latitude 38° 42' 14" North, Longitude 121° 04' 51" West). With approximately 575 students, it is a traditional K-5 elementary school in the Rescue Union School District. Some of the school's facilities include approximately 26 classrooms (all carpeted), an administration building, a library, a computer laboratory, a grass-covered playing field with grass-infield baseball diamonds, an outdoor classroom and garden, two paved play areas with basketball courts and tetherball, and play structures. The outdoor classroom and garden area is a place where students participate in gardening activities as part of the educational program.

Rolling Hills Middle School is located at 7141 Silva Valley Parkway (Latitude 38° 40' 54" North, Longitude 121° 04' 07" West). Built in its current location in 1998, the school is a year-round middle school (6^{th} to 8^{th} grades) with more than 700 students. The school is part of the Buckeye Union School District. Some of the school's facilities include classrooms, an administration building, a library, a grass-covered soccer field, and a paved basketball play area. The Dirt Embankment is a dirt embankment/hillside behind Rolling Hills Middle School and inside its eastern boundary.

The Dirt Parking Area is an unpaved lot used for parking on public property in front of Rolling Hills Middle School, outside its western boundary. The property is apparently under the jurisdiction of the El Dorado County Department of Transportation and is said to be used regularly as a parking lot primarily by high school students who attend the nearby Oak Ridge High School.

1.2.3 Site History and Previous Investigations

Exposure risk from naturally occurring asbestos, particularly an exposure occurring as a result of construction activities, has been a concern in El Dorado County for some time. (See *Findings and Recommendations on Naturally-Occurring Asbestos to El Dorado County*, State of California Asbestos Task Force, March 11, 1999.) The naturally occurring asbestos in the El Dorado Hills area of the county is primarily associated with the Bear Mountains Fault Zone; in the vicinity of the Community Park, the fault runs roughly north to south between El Dorado Hills Boulevard and Silva Valley Parkway. Ultramafic rock, which identifies the fault, is exposed in the road cut on the south side of Harvard Way, west of Oak Ridge High School. Both chrysotile and amphibole asbestos are present in geologic formations in El Dorado Hills.

While Oak Ridge High School is not part of the El Dorado Hills Naturally Occurring Multimedia Assessment, it is centrally located between the majority of the locations that are included in the assessment, and it is in a geologically similar region. In February 2002, construction began of two soccer fields along the southwest border of Oak Ridge High School. During construction, veins of asbestos-bearing minerals were disturbed.

The El Dorado Union High School District reportedly encountered difficulties in acquiring reclaimed irrigation water for the project, so the soccer fields were left without landscaping for more than a year while a solution was sought. Subsequent erosion of disturbed, potentially asbestos-bearing soils from the unfinished fields caused by winter rains in 2002/2003 impacted classrooms and locker rooms downslope. In addition, the El Dorado Union High School District, in coordination with the El Dorado County Environmental Management Department (CoEMD) and DTSC, identified other areas of concern on the campus.

This led the school district to undertake mitigation activities at Oak Ridge High School in the summer of 2003. Mitigation actions undertaken by the school district are described in the *El Dorado Union High School District Oak Ridge High School Naturally Occurring Asbestos (NOA) Operations and Maintenance (O&M) Plan*, dated December 2003, prepared by MACTEC Federal Programs (MACTEC).

The CARB has conducted air monitoring in several locations in California to determine levels of asbestos in air at selected sites. In April 1999, the CARB measured ambient asbestos concentrations in air at seven monitoring locations at and near Silva Valley Elementary School. Of the 20 samples collected at the school, four of the samples contained detectable levels of asbestos; the highest level detected (in two of the samples) was 0.0019 fibers per cubic centimeter (f/cc).

The CARB conducted air sampling in June and July 2003, to assess the type and quantity of asbestos fibers released to ambient air during mitigation activities at the soccer fields. The CARB sampling documented the presence of asbestos in ambient air samples collected during mitigation activities, with a maximum asbestos level recorded in air of 0.0039 structures per cubic centimeter (s/cc) and an average concentration at the mitigation fence line of 0.001 s/cc. A complete description of the CARB sampling locations, methodology and findings is available in the November 6, 2003, CARB report *Sampling for Airborne Naturally Occurring Asbestos at Oak Ridge High School June 2003*.

Due to citizens' concerns about asbestos on the Oak Ridge High School campus, the U.S. EPA and START conducted an assessment of surficial soil at the high school in November 2003 to determine whether additional mitigation efforts were required in areas other than those related to the soccer fields. During the assessment exposed soils throughout the campus were sampled, particularly those areas where observed or expected student or public traffic could disturb asbestos-containing soil or rock. Sampling documented that asbestos was present in exposed soils throughout the campus ranging from less than 0.0001 to 8.8 percent by weight. U.S. EPA subsequently performed remediation at Oak Ridge High School by covering exposed soil with landscaping, concrete, or pavement.

1.3 Project and Task Description

1.3.1 Project Objectives

During this multimedia exposure assessment, outdoor air and soil samples will be collected from a number of specific El Dorado Hills locations. Activity-based outdoor air sampling will be conducted at many of the locations. Ambient outdoor air samples also will be collected as reference samples. All sample data collected during the project will assist the U.S. EPA in identifying and estimating associated exposure levels for locations in El Dorado Hills where there is a potential for exposure to asbestos from disturbed areas of naturally occurring asbestos.

- Activity-based outdoor air samples will be collected from the Community Park, the New York Creek Nature Trail, and three schools in El Dorado Hills. The U.S. EPA will use the activity-based outdoor air data collected during the project to document whether and at what concentrations asbestos fibers are present in outdoor air during activities conducted at sampled locations on the days of sampling. The START will collect activity-based outdoor air samples under conditions ranging from minimal activity to dust generation activities while members of the sampling team wear personal sample pumps. In addition, stationary air samplers will be set up in and around the activity areas during most of the activity-based sampling.

- The START also will set up fixed air samplers at the Community Park and schools to collect ambient outdoor air samples collected from outside activity areas to serve as reference samples.

- The START will collect surface soil samples at the Community Park, the Dirt Embankment, the Dirt Parking Area and the schools to document whether and at what concentrations asbestos fibers are present in soil at sampled locations. At the baseball playing fields at the Community Park, where the infield skin is imported material, the START also will collect shallow subsurface soil samples from at and below the interface of the infield fill and the soil beneath. These samples may be held for analysis to use if mitigation is planned for the area.

1.3.2 Project Scope of Work

The U.S. EPA has directed the START to develop a QAPP and FSPs and to conduct all field activities. The START will assist the U.S. EPA with the project objectives planning, including the development of data quality related objectives using the U.S. EPA's Data Quality Objective (DQO) planning process. The START has developed this QAPP based upon the DQO planning process and supporting FSP and analytical SOW documents, included as appendices to this QAPP. The START will be responsible for implementation of the QAPP, FSPs and analytical SOWs.

The START will conduct ambient outdoor air sampling and activity-based outdoor air sampling for asbestos, real-time air monitoring to measure total dust, soil sampling for asbestos, meteorological data collection, and video monitoring to document dust generation and sampling. The START will procure subcontractors as needed to aid in the collection of the air samples, preparation and analysis of samples, and validation of generated data. The U.S. EPA QAO will oversee the data validation of the analytical results. This QAPP describes the QA/QC protocols for the collection, preparation, and analysis of all samples.

The START will use the Scribe data management system to manage asbestos and meteorological data generated as part of the project. Scribe is a software tool developed by the U.S. EPA's Environmental Response Team (ERT) to assist in the process of managing environmental data.

1.3.3 Project Schedule

Outdoor air sampling, soil sampling, and estimating the exposure of residents to airborne contamination is a priority for both the community and the U.S. EPA. Air sampling activities are scheduled to begin in late September or early October 2004. The proposed schedule assumes that the review and approval of the QAPP and FSPs by the U.S. EPA and other stakeholders will be completed in a timely manner.

1.4 Quality Objectives and Criteria for Measurement Data

To assist in addressing the community's concerns regarding exposure to asbestos from disturbed areas of naturally occurring asbestos, an investigation will be conducted to determine the asbestos concentration of outdoor air and soils in El Dorado Hills. Analytical data from the air investigation will be compared to project-specific reference levels established through sampling (see Appendix F for discussion). Analytical data from soil sampling will be used to document the asbestos concentrations of exposed and below-grade soils within specific activity areas. Results of the U.S. EPA’s investigation will be shared with other agencies.

1.4.1 Data Quality Objective (DQO)Process

The DQO process, as set forth in the U.S. EPA documents, *Data Quality Objectives Process for Hazardous Waste Site Investigations* (EPA QA/G-4HW, January 2000, EPA/600/R-00/007) and *Guidance for the Data Quality Objectives Process* (EPA QA/G-4, August 2000, EPA/600/R-96/055) was followed to establish the data quality objectives for this project. An outline of the process and the outputs for this project are included in Appendix A.

1.4.2 Decision Rules

Outdoor Air Sampling

If mean asbestos structure concentrations are documented to be statistically higher than mean reference levels in outdoor air at the sampled breathing height in or downwind of an area of concern, then public activity at that location may need to be restricted, and further study and/or asbestos mitigation may be necessary. If mean asbestos structure concentrations are documented to be at or below mean reference levels in outdoor air at the breathing height sampled in or downwind of an area of concern, then no further study may be required. The decision process diagram is presented in Figure 1-3A.

Insert Figure 1-3A, 1-3B

Soil Sampling
If asbestos structures in soil samples are determined by polarized light microscopy (PLM) to be below 1 percent (area percent), then associated samples will undergo confirmatory analysis by transmission electron microscopy (TEM). The decision process diagram is presented in Figure 1-3B.

1.4.3 Action Levels
There are no site-specific action levels for air and soil results established for this exposure assessment. Sample results will be compared to reference levels, as discussed in Appendix F, Reference Levels and Analytical Sensitivity. The real-time measurement of dust is being used to document conditions during the outdoor air sampling and is not associated with an action level.

1.4.4 Analytical Sensitivity
The data generated for this project must be obtained with a sensitivity sufficiently low to be useful for direct comparison to reference levels. The reference levels and analytical sensitivity are discussed in Appendix F, Reference Levels and Analytical Sensitivity.

Achieving the analytical sensitivity for asbestos in air samples is generally dependent on two factors: the volume of air collected through the filter and the area of the filter searched (i.e., number of grid sections searched multiplied by the area of the grid sections searched). The required sensitivity will be achieved for each collected air sample by collecting as large a volume of air as practical and by increasing the filter search areas, if needed. Achieving the analytical sensitivity for asbestos in soil samples generally is dependent on the size of the search area of the prepared soil sample (i.e., number of grid sections searched multiplied by the area of the grid sections searched). The required sensitivity will be achieved for each collected soil sample by increasing the search areas as needed.

1.4.5 Data Quality Indicators
To achieve the project objectives, the asbestos fiber and structure data generated for this project must be accepted as qualitatively and quantitatively useful. Data Quality Indicators (DQIs) are descriptors used to gauge the acceptability of data. The primary DQIs of precision, accuracy, bias, representativeness, comparability, and completeness for this project are addressed in the following paragraphs.

Precision and Accuracy
Quantitative and qualitative objectives for the data quality indicators for precision and accuracy are provided in Table 1-1. Quantitative precision objectives are dependent upon the number of structures or fibers counted and are expected to correspond to a Poissonian distribution's 95 percent confidence interval. Quantitative accuracy objectives are based on the 95 percent confidence interval since there is no known independent method for determination of absolute accuracy in asbestos samples. Internal laboratory control samples, quarterly inter-laboratory performance verification samples, and project-specific performance evaluation (PE) samples will be evaluated in reference to the 95 percent confidence interval for Poissonian distributions. The required frequency of precision and accuracy samples is provided in Table 1-2.

Table 1-1:
Precision and Accuracy Objectives

Method	Name/ Method Description	Precision Laboratory Replicates	Precision Laboratory Duplicates	Precision Co-located Samples	Accuracy Internal and Intra Laboratory Evaluation Sample	Accuracy Performance Evaluation Samples
ASBESTOS IN AIR (Direct Analysis)						
ISO 10312	*Ambient air–Determination of asbestos fibres–Direct-transfer transmission electron microscopy method* with project-specific specification.	Acceptable Relative Percent Difference (RPD) value will be based upon the 95% confidence interval of a Poisson distribution for structures counted.	Acceptable RPD value will be based upon the 95% confidence interval of a Poisson distribution for structures counted.	Acceptable RPD value will be based upon the 95% confidence interval of a Poisson distribution for structures counted.	Acceptable reported concentration 95% confidence interval.	Acceptable reported concentration 95% confidence interval.
ASBESTOS IN AIR (Indirect Analysis)						
ISO 13794	*Ambient air–Determination of asbestos fibres–Indirect-transfer transmission electron microscopy method* with project-specific specification.	Acceptable RPD value will be based upon the 95% confidence interval of a Poisson distribution for structures counted.	Acceptable RPD value will be based upon the 95% confidence interval of a Poisson distribution for structures counted.	Acceptable RPD value will be based upon the 95% confidence interval of a Poisson distribution for structures counted.	Acceptable reported concentration 95% confidence interval.	Acceptable reported concentration 95% confidence interval.
ASBESTOS IN SOIL						
NIOSH 9002 EPA 600/R-93/116	*Asbestos (bulk) by PLM* *Method for the Determination of Asbestos in Bulk Building Materials*	Acceptable RPD value will be based upon the 95% confidence interval of a Poisson distribution for structures counted.	Acceptable RPD value will be based upon the 95% confidence interval of a Poisson distribution for structures counted.	Acceptable RPD value will be based upon the 95% confidence interval of a Poisson distribution for structures counted.	Acceptable reported concentration 95% confidence interval.	Acceptable reported concentration 95% confidence interval.

Table 1-2:
Field and Laboratory QC and QA Sample Frequency Guidelines

FIELD SAMPLES	MATRIX	FREQUENCY
Co-located Samples	Outdoor Air	One per ten samples for each analysis
Field Trip Blanks	Outdoor Air	Two per day*
Filter Blanks	Outdoor Air	One per day*
Performance Evaluation Samples	Outdoor Air	One set per laboratory used for project. Every 6 months for laboratory where samples are to be received over a 1 year period.
Field Duplicate	Soil	One per ten samples for each analysis
LABORATORY SAMPLES		**FREQUENCY**
Replicate Analysis: New grids counted by same analyst	Outdoor Air Soil	One per 20 samples for each analysis
Replicate Analysis: New preparation by same analyst	Outdoor Air Soil	One per 20 samples for each analysis
Duplicate Analysis: Same grids recounted by different analyst	Outdoor Air Soil	One per 20 samples for each analysis
Duplicate Analysis: New grids counted by different analyst	Outdoor Air Soil	One per 20 samples for each analysis
Duplicate Analysis: New preparation by different analyst	Outdoor Air	One per 20 samples for each analysis
Inter-Laboratory performance evaluation	Outdoor Air Soil **	One per project for each analyst
Intra-Laboratory performance evaluation	Outdoor Air Soil **	One per quarter for each analyst

* The frequency of field trip blanks and filter blanks will be modified for sampling that involves multiple days of sampling with one or two samples collected per day. In those situations the frequency will be one per ten samples.
** All Intra-Laboratory performance evaluation samples will be submitted as air filter samples, even for the soil analytical laboratory. There are no performance evaluation samples available in the soil matrix.

Bias
The sampling bias for activity-based outdoor air samples is based upon the project objectives, which bias toward the measurement of maximum concentrations. Collection of ambient reference air samples and upwind samples is not intended to be biased. Soil sampling will be biased toward areas where there is exposed surface soil. Except for the subsurface soil samples that will be collected at the Community Park baseball playing fields, soil samples will not be collected from areas that are covered entirely with vegetation, or beneath structures, asphalt, concrete, or other similar materials.

Representativeness
For outdoor air sampling, the use of continuous sampling over each sampling period is intended to be representative of the air during the specific time period at specific locations during specific activities. The sample collection heights for the activity-based sampling are intended to be representative of the air at the active child (ages 1 to 7 years), active youth (ages 7 to 17 years), and adult breathing heights. Refer to Table 1-3 for collection height objectives.

Fixed ambient reference air sampling over 8-hour periods before and during activity-based sampling is intended to be representative of ambient air conditions during the specific time period that the sampling occurs. The sample collection heights for the fixed ambient reference air sampling are intended to be representative of the ambient air at the active youth breathing height.

Surface soil samples are intended to be representative of exposed soils in the areas sampled. Surface soil sampling at baseball playing fields is intended to be representative of the entire baseball infield area. Subsurface soil samples at the Community Park baseball playing fields are intended to be representative of soil beneath the imported infield material.

Comparability
The outdoor air sampling data will be generated using the International Organization for Standardization Method 10312 (ISO 10312), *Ambient air–Determination of asbestos fibres–Direct-transfer transmission electron microscopy method*. The use of this method is intended to generate air sampling data that are comparable to international and national standards. If outdoor air sample filters become excessively dusty (i.e., overloaded) during sampling, the use of ISO 13794, *Ambient air–Determination of asbestos fibres–Indirect-transfer transmission electron microscopy method*, may be required for their analysis. The analytical laboratory, in consultation with the E & E START Project QA Coordinator, will determine which samples meet the criteria for requiring the indirect analysis method.

Soil sampling data will be comparable to other U.S. EPA soil sampling investigations. This will be established by using standardized analytical methods (NIOSH 9002 and EPA 600/R-93/116) for determination of asbestos in bulk samples. In addition, a standardized soil preparation method (ISSI-LIBBY-01, Revision 8, May 6, 2004) that was developed by U.S. EPA Region 8 has been modified for use on this project, and is included as Appendix D.

Table 1-3:
Air Collection Height Objectives

Sample Type	Matrix	Objective Sampling Height Above Ground Surface
Activity-based personal air samples (youth)	Outdoor Air	Active youth–3 feet
Activity-based personal air samples (adult)	Outdoor Air	Adult–5 feet
Children's playground high-volume air samples collected during Community Park playing field and biking scenarios	Outdoor Air	Active child–3 feet
Children's playground high-volume air samples collected during Community Park playing field and biking scenarios–daily composites	Outdoor Air	Active child–3 feet
Upwind high-volume air samples	Outdoor Air	Active youth–3 feet
Downwind/area of concern high-volume air samples	Outdoor Air	Active youth–3 feet
Fixed ambient high-volume reference air samples	Outdoor Air	Active youth–3 feet
Dust monitoring data	Outdoor Air Playground	Active youth–3 feet Active child–3 feet

Completeness
The data completeness objectives vary with the type of data collected. Based upon project objectives, all activity-based outdoor air data collected using personal samplers is deemed to be critical data. Table 1-4 shows the various types of sampling data and the corresponding completeness objectives. Critical samples will be identified in each FSP. Measurement data lost or unusable due to equipment failure, sample handling, and data qualified as rejected during the data validation are not usable and will be considered incomplete. Qualified data, if not rejected, will be considered usable for decisions, exposure calculations, and exposure assessment.

To achieve the completeness objectives, redundant samplers will be used, back-up samplers will be readied, and in some situations, required sample volumes will be reduced. Critical samples without redundancy that are lost may require re-sampling. Critical sample data that are rejected may require either re-sampling or re-analysis depending upon the situation.

Composite sampling data will be collected that will help determine the final completeness requirements for the project. Those critical composite samples will be identified in each FSP.

**Table 1-4:
Completeness Objectives**

Sampling Data Type	Matrix	Completeness Objective
Activity-based personal air samples (youth)	Outdoor Air	100 %*
Activity-based personal air samples (adult)	Outdoor Air	100 %**
Children's playground high-volume air samples collected during Community Park playing field and biking scenarios	Outdoor Air	100 %
Children's playground high-volume air samples collected during Community Park playing field and biking scenarios–daily composites	Outdoor Air	100%
Upwind high-volume air samples	Outdoor Air	80 %
Downwind/area of concern high-volume air samples	Outdoor Air	80 %
Fixed ambient reference high-volume air samples	Outdoor Air	100 %
Dust monitoring data	Outdoor Air	60 % per scenario
Soil samples	Soil	80 %

* Data from five personal air sampling pumps from each scenario.
** Data from one personal air sampling pump from each scenario.

1.4.6 Performance Evaluation

Blind PE samples will be submitted to the analytical laboratories for analysis with field samples, and performance will be evaluated with other QA data. The PE sample will be a collection filter with a known concentration of asbestos. The evaluation of the PE data has two objectives. The first objective is to have an independent verification of the laboratory's ability to identify asbestos. The second objective is to provide independent precision and accuracy data with regard to the laboratory's ability to quantify asbestos in the samples. For this project, one PE sample will be submitted blind to each of the analytical laboratories that are used (for air as well as soil analysis laboratories).

While a PE sample specifically for soil (i.e., in a soil matrix) is not available, the laboratory that analyzes the soil samples also will be given a PE sample of asbestos on a filter (similar in construction to the PE sample that will be sent to the laboratory that analyzes the air samples). The laboratories will not be given advance knowledge of the asbestos concentration on the filters, so the submissions are considered blind. The submissions are not considered double-blind, however, because the laboratories will be aware they are evaluating PE samples based on the samples' different construction, even for the air samples.

1.5 Special Training Requirements/Certifications

Soil samples that are collected will be logged by a California registered geologist using the Unified Soil Classification System (USCS) following procedures and protocols described in E & E's SOP for geologic logging (Appendix D). All field team members will have fulfilled the training requirements relevant to E & E's health and safety program, which comply with 29 CFR 1910.120 and are detailed in the HSP (Appendix C). There are no other certification requirements for field team members specific to this project. The team member in charge of air sample collection must have previous experience in collection of air samples and with the collection of asbestos fibers in air.

All laboratories used for this project will be participants in the National Institute of Standard and Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP). Laboratories selected for analysis of air samples will have previous experience in the analysis of asbestos fibers collected on air filters using ISO 10312 and ISO 13794. Laboratories selected for preparation of soil samples will have previous experience with bulk soil sample preparation by ISSI-LIBBY-01 (Revision 8, May 6, 2004), a standardized soil preparation method that was developed by U.S. EPA Region 8. Laboratories selected for analysis of soil samples will have previous experience with bulk soil sample preparation and analysis by NIOSH 9002 and EPA 600/R-93/116. In addition, the laboratories must have demonstrated experience or expertise with determination of both chrysotile and amphibole asbestos and must have previous U.S. EPA project experience.

A third-party analytical data validator will be used; the data validator will have experience in the verification of analytical documentation with regard to asbestos analysis by TEM methods.

1.6 Documentation and Records

All field and analytical records generated during the assessment, including log books, photographic records, video records, field data sheets, laboratory reports, data validation packages, data validation reports, and computer file data shall be maintained by START for reference until the expiration of the START contract in centrally located files at E & E's San Francisco office. Upon expiration of the START contract, all project-related records and documents will be submitted to the U.S. EPA.

Field Sampling Plans

Four separate FSPs will be written to address different task-specific field sampling components of the El Dorado Hills Naturally Occurring Asbestos Multimedia Exposure Assessment (e.g., two for activity-based outdoor air, ambient outdoor reference air, soil). The FSPs will describe in detail the planned sample locations and sample location rationale. The FSPs will specify numbers of samples and specific sample collection and handling techniques. The FSPs also will document protocols and sample custody procedures required to ensure that sample integrity is not compromised. Each FSP will be approved independently of the QAPP. The FSPs are a part of this QAPP in Appendix B.

Health and Safety Plan

Before any field sampling occurs, the START will prepare the HSP that identifies the health and safety protocols to be used during the task-specific field sampling to be conducted under each of the FSPs. The HSP will be approved by the E & E Health and Safety Manager and will be submitted to the U.S. EPA with the FSPs. In general, activity-based outdoor air sampling will be conducted in Level C personal protection. All other activities are expected to be conducted in Level D personal protection. The HSP is in Appendix C.

Project Status Reports to Management
Per standard START practices, the START Project Manager will report any issues that arise during the course of the project that could affect data quality, data use objectives, project objectives, or project schedules to the U.S. EPA Task Monitor.

Written Assessment Report and Related Deliverables
After assessment activities are completed, a written report will be delivered to the U.S. EPA Task Monitor and will include, but is not limited to:

- Detail of assessment activities, including a discussion of any variances to the FSPs;
- Validated and verified analytical data; and
- Field measurement data.

Other deliverables may include the following:

- Video and photographic documentation; and
- Database records.

2 Measurement and Data Acquisition

2.1 Sampling Design

To accomplish several different types of sampling at various locations, the project design incorporates the use of four separate FSPs that can be implemented independently. If the need for additional study arises, supplemental FSPs may be developed. The four FSPs, which are included as Appendix B are as follows:

- Activity-Based Outdoor Air Sampling of Community Park and Schools;
- Activity-Based Outdoor Air Sampling of Community Park Children's Playground;
- Fixed Ambient Outdoor Reference Air Sampling; and
- Soil Sampling of Community Park, Schools, and Public Areas.

The specific design, sampling method requirements, sample handling and custody requirements, measurement parameters, QA/QC procedures and QC sample requirements are discussed in detail in the FSPs in Appendix B. The four FSPs address the following types of sampling and data acquisition:

- Activity-based personal outdoor air sampling;
- Activity-based stationary outdoor air sampling;
- Fixed ambient reference air sampling;
- Soil sampling, including geologic logging of soil samples;
- Real-time dust monitoring;
- Meteorological data collection; and
- Video monitoring of fugitive dust present during outdoor air sampling;

2.1.1 Activity-Based Outdoor Air Sampling Design

Outdoor air samples will be collected during 20 different activity-based sampling events or scenarios that have been designed to take place at the Community Park and the three schools. Each scenario will be conducted following a sampling outline or script that will specify the activities for each member of the sampling team. The scenarios are designed so that activity will be conducted at areas of concern for the duration of the scenario in an attempt to suspend particles and fibers into the air. The scenarios will simulate activities ranging from minimal to aggressive dust generation to measure exposures that may occur from sports and other activities that generate dust.

During each activity-based sampling scenario, five sampling team members will collect personal air samples by wearing personal air sample pumps while conducting sampling activities within each scenario area of concern. One other sampling team member will wear a personal air sample pump at the periphery of the scenario activities. In addition, five stationary high-volume air sample pumps will be positioned in, upwind, and downwind of sampling activity areas of concern during most of the activity-based scenario sampling.

The areas of concern include the following locations, which are shown on Figure 2-1: Scenario Location Map:

- Children's playground at the Community Park;
- New York Creek baseball playing field at the Community Park;
- North baseball playing field at the Community Park;
- South baseball playing field at the Community Park;
- Lower soccer field (between the north and south baseball playing fields) at the Community Park;
- New York Creek Nature Trail;
- Baseball playing field at Silva Valley Elementary School;
- Basketball court area at Rolling Hills Middle School;
- Soccer field at Rolling Hills Middle School;
- Playing field at Jackson Elementary School;
- The garden and outdoor classroom at Jackson Elementary School; and
- Bare areas, pathways, and paved play areas at Jackson Elementary School.

Children's Playground at the Community Park
For the children's playground, which is directly adjacent to (and southwest of) the south baseball playing field at the Community Park, there are two considerations. The first is the potential for asbestos fibers to be present at the playground and for it to become airborne during play activities either due to the activities themselves or due to the wind or both. Two scenarios have been developed to address this consideration. The second consideration is the potential for asbestos fibers to be present in air at the playground as a result of activities at the baseball/soccer playing fields. Consequently, the sample design includes placement of samplers at the children's playground during all playing field and area scenarios at the Community Park.

Insert Figure 2-1

Playing Fields and Areas at Silva Valley Elementary School, Rolling Hills Middle School, and the Community Park

For the seven other playing fields and areas at Silva Valley Elementary School, Rolling Hills Middle School, and the Community Park, there are several considerations. The first is the potential for asbestos fibers to be present at the playing fields or areas and for it to become airborne during play activities either due to the activities themselves or due to the wind or both. Eleven scenarios have been developed to address this consideration. At least one scenario will be conducted at each of the seven playing fields and areas, and to increase the viability of generated data, at two of these locations the scenarios will be repeated two additional times. The two areas are the baseball playing field at Silva Valley Elementary School and the south baseball playing field at the Community Park. Another consideration is the potential for asbestos fibers to be present in air around and downwind of the playing fields or areas. Consequently, the sample design includes placement of downwind samplers and personal samplers at the periphery of scenario areas.

The final consideration is the wind direction. Since the wind direction in the El Dorado Hills area is variable, a meteorological station will be set up at a secure location at the Community Park (west of the children's playground) to monitor wind speed and direction for several days prior to and during collection of air samples. The actual location of the upwind and downwind samplers will need to be determined immediately prior to each scenario and will be based primarily on wind direction. For the playing fields and areas not at the Community Park, a portable meteorological station also will be used prior to sampling to identify wind conditions and determine appropriate sample locations for those scenarios. In addition, selection of appropriate sampler locations will require consideration of their placement away from physical structures that may impede the wind flow in their vicinity.

Garden Area/Outdoor Classroom and Playing Field at Jackson Elementary School

For the garden area/outdoor classroom and the playing field at Jackson Elementary School, there are several considerations. The first is the potential for asbestos fibers to be present at the areas and for it to become airborne during play or class activities either due to the activities themselves or due to the wind or both. Two scenarios have been developed to address this consideration. Another consideration is the potential for asbestos fibers to be present in air around and downwind of the areas of concern as a result of activities there. Consequently, the sample design includes placement of downwind samplers and personal samplers at the periphery of scenario areas.

The final consideration is the wind direction. Since the wind direction in the El Dorado Hills area is variable, a portable meteorological station will be set up at the school to monitor wind speed and direction prior to and during collection of air samples. The actual location of the upwind and downwind samplers will need to be determined immediately prior to each scenario, and data from the portable meteorological station at the school as well as the meteorological station at the children's playground at the Community Park will be used to base the decision on placement. Selection of appropriate sampler locations also will require consideration of their placement away from physical structures that may impede the wind flow in their vicinity.

The New York Creek Nature Trail and Bare Areas/Pathways and Paved Play Areas at Jackson Elementary School

For the New York Creek Nature Trail and bare areas/pathways and paved play areas at Jackson Elementary School there is concern for the potential for asbestos fibers to be present in the area and for it to become airborne during walking, hiking, running, and biking activities either due to the activities themselves or due to the wind or both. One scenario at Jackson Elementary School and two scenarios performed in replicates on different days at the New York Creek Nature Trail have been developed to address this consideration. Sampling activities at the New York Creek Nature Trail will be done in replicates to increase the viability of generated data.

2.1.2 Fixed Ambient Reference Air Sampling Design

Ambient air samples will be collected for up to five days prior to and during scenario sampling at a fixed location at the Community Park in the vicinity of the meteorological station. Dust concentrations will be monitored, and samples from this fixed location will be collected daily over an 8-hour interval that will coincide with the anticipated and actual scenario sampling time periods. The purpose of this sampling is to document the ambient level of asbestos fibers in the vicinity of the Community Park in the days prior to and during the scenario sampling to serve as reference data.

In addition, ambient air samples will be collected as reference samples from fixed locations within two generalized areas in the community at locations outside the specific areas of concern. The first generalized reference sample locations will be from the area around Jackson Elementary School, and the second generalized reference sample locations will be from the area around Silva Valley Elementary School, Rolling Hills Middle School, and the Community Park.

The locations of these fixed ambient reference air reference sample pumps will be selected while in the field prior to conducting the activity-based air sampling. Their locations will be selected based on the following criteria:

- At least 100 yards away from activity-based sampling areas of concern, so as to be considered not influenced by sampling activities.

- Either on school or Community Park property, or on other public property, with permission from proper authority.

- Five fixed ambient reference air sample pumps will be positioned in the area around Jackson Elementary School, and samples from these air sample pumps will be collected for one day prior to, one day after, and all during activity-based sampling at Jackson Elementary School.

- Five fixed ambient reference air sample pumps will be positioned in the area around Silva Valley Elementary School, Rolling Hills Middle School, and the Community Park, and samples from these air sample pumps will be collected for one day prior to, one day after, and all during activity-based sampling at those locations.

Dust concentrations also will be monitored at these fixed locations. Sampling at the fixed ambient reference air sampling locations will be continuous for about 8 hours over each sampling day. The areas where fixed ambient reference air sampling will be conducted are illustrated on Figure 2-2: Fixed Ambient Reference Air Sampling Location Map.

2.1.3 Soil Sampling Design

To locate and determine concentrations of asbestos in areas of disturbed soil within scenario areas, surface soil samples will be collected from the exposed soil areas. To locate and determine concentrations of asbestos in areas of disturbed soil in other identified public areas, surface soil samples will be collected from the exposed soil areas. To obtain data on asbestos content in the soils underlying the infield turf at the Community Park baseball playing fields, subsurface soil samples will be collected but analyzed only if the U.S. EPA Task Monitor determines that doing so would be needed to help identify sources of asbestos structures and to evaluate alternative mitigation measures. The design for the soil sampling includes the collection of representative (random) and biased surface soils from discrete locations.

Random and biased soil samples will be collected from the baseball playing fields. Surface soil samples from soccer/grass-covered playing fields and the outdoor classroom/garden are biased toward exposed areas, with samples collected randomly within the exposed areas. Subsurface soil samples from Community Park baseball playing fields will be co-located with surface soil samples. The New York Creek Nature Trail will be divided into 1000-foot segments, and both random and biased surface soil samples will be collected from within the segments. Shorter pathway and bare area segments will be selected at Jackson Elementary School, and both random and biased surface soil samples will be collected from within the segments. At the Dirt Embankment (at Rolling Hills Middle School), only biased surface soil sampling will be conducted. The Dirt Parking Area (adjacent to Rolling Hills Middle School) will be divided into segments, and both random and biased surface soil samples will be collected from within the segments. The specific areas where soil samples will be collected are included in the FSP.

2.2 Sampling Requirements

The specific sampling requirements are discussed in detail in the FSPs. All samples will be collected, stored under chain-of-custody, and shipped according to procedures outlined in E & E and U.S. EPA Emergency Response Team (ERT) SOPs (Appendix D).

2.2.1 Activity-Based Outdoor Air Sampling Requirements

Each air sampling scenario will run for 2 hours, during which the samples will be collected on air filters using air sampling pumps. Some air sample pumps also will be used to collect composite samples of multiple sampling scenarios for a maximum collection duration of about 6 to 8 hours. The 2-hour scenario duration was chosen to enable the sampling team to simulate representative activities and obtain sufficient outdoor air volume for the desired analytical sensitivity. Since the U.S. EPA desires to impact the community as little as possible during the sampling, the total field sampling duration is designed to be as short as practical.

Insert Figure 2-2

The sampling design calls for the use of high-flow sample pumps, which must be capable of maintaining a constant flow of 10 liters/minute (±10%) through a filter under moderately dusty conditions without pump faulting. The recommended filter for TEM analysis has a pore size of 0.45 micrometers (µm), but flow rates of 10 liters/minute could potentially damage a 0.45 µm filter. Previous attempts using the 0.45 µm filter in dusty conditions for outdoor air sampling conducted by U.S. EPA at Oak Ridge High School have shown that the small pore size can restrict the flow and cause pump faulting.

To prevent this situation, phase contrast microscopy (PCM) filters with a pore size of 0.8 µm will be used instead, as is now commonly done for sampling under dusty conditions. U.S. EPA and MACTEC have successfully used PCM filters with a pore size of 0.8 µm during previous air investigations for asbestos at Oak Ridge High School and at sampling locations in U.S. EPA Regions 2, 8 and 10. There is limited information comparing sampling results obtained using the 0.8 µm pore filter to sampling results obtained using the 0.45 µm pore filter, but it has been suggested that the use of the larger pore size filter may bias the results low (since some of the smaller particles between 0.45 µm and 0.8 µm may pass through the filter).

The sampling design also includes the use of several personal sampling pumps, which must be capable of maintaining a constant flow of 2.5 liters/minute (±10%) through a filter under moderately dusty conditions without pump faulting. Because the use of a 0.45 µm filter on these personal sampling pumps is expected to generate excess back pressure, restrict flow, and cause pump faulting, the START will use PCM filters with a pore size of 0.8 µm to ensure successful collection of outdoor air samples at sufficient volumes using portable samplers.

2.2.2 Fixed Ambient Reference Air Sampling Requirements

Fixed ambient reference air sampling will be done to collect 8-hour composite samples using high-flow sample pumps and filters with a pore size of 0.8 µm. There will be one high-flow sample pump placed in a fixed position in a secure location at the Community Park (west of the children's playground) to collect reference air samples for several days prior to and during the collection of activity-based outdoor air samples. Five fixed ambient reference air sample pumps will be positioned in the area around Jackson Elementary School (Northern Reference Area), and samples from these air sample pumps will be collected for one day prior to, one day after, and all during activity-based sampling at Jackson Elementary School. Five fixed ambient air short-term reference sample pumps will be positioned in the area around Silva Valley Elementary School, Rolling Hills Middle School, and the Community Park (Southern Reference Area), and samples from these air sample pumps will be collected for one day prior to, one day after, and all during activity-based sampling at those locations.

The fixed ambient reference air samples will be collected during activity-based outdoor air sampling activities for a maximum collection duration of about 8 hours. The locations of each fixed ambient reference air sample pump will not change throughout the entire duration of the project, but samples will not be collected from all locations during every scenario. Data from the meteorological station will be used to interpret whether the activity-based samples are upwind, downwind, or crosswind of the reference samples.

2.2.3 Soil Sampling Requirements

All soil samples will be collected, stored under chain-of-custody, and shipped according to procedures outlined in E & E and U.S. EPA Emergency Response Team (ERT) SOPs (Appendix D). Surface and subsurface soil samples will be held for shipment to the soil preparation laboratory pending a decision to analyze the samples by the U.S. EPA Task Monitor.

Surface soil samples from baseball playing field areas will be collected as composite samples from seven random locations within the baseball playing field infield areas. In addition, biased sampling will be conducted around the base paths and home plate. The actual locations around the bases will be selected at random.

Surface soil samples from soccer/grass-covered playing fields and the outdoor classroom/garden will be collected from at least three and up to seven discrete locations in areas where exposed soil is found. The actual locations will be selected at random.

Surface soil samples from the New York Creek Nature Trail and pathways/bare areas at Jackson Elementary School will be collected at locations along the entire length of the trail and in areas where there is exposed soil. The actual locations will be selected at random. At least 24 random surface soil samples will be collected from the New York Creek Nature Trail. In addition, biased samples will be collected from areas of apparent heavy use.

Biased and random surface soil samples will be collected from the Dirt Parking Area that is in front of Rolling Hills Middle School.

Biased surface soil samples will be collected from exposed areas of the Dirt Embankment that is behind and within the eastern boundary of Rolling Hills Middle School.

2.3 Analytical Methods Requirements

The specific analytical requirements are discussed in detail in the analytical SOW (Appendix E). Table 2-1 presents a summary of the proposed samples and analytical requirements.

2.3.1 Activity-Based Outdoor Air Analytical Methods Requirements

Activity-based outdoor air samples will be submitted to the laboratory within five days of collection of the sample. Samples will be analyzed to determine asbestos structures and fibers concentrations by TEM analysis. The analysis will determine and report regulated and potentially toxic non-regulated asbestiforms (e.g., so-called “Libby amphiboles”). Reporting shall include concentration and 95 percent confidence interval for the following data:

- Total structures per cubic centimeter (cc);
- Structure counts with length greater than 5 µm and having at least 3:1 aspect ratio;
- Structure counts with length greater than 5 µm but less than or equal to 10 µm and having a diameter less than or equal to 0.5 µm; and
- Structure counts with length greater 10 µm and having a diameter less than or equal to 0.5 µm.

Table 2-1
Summary of Sampling with Analytical Methods

Sample Type	**Activity-Based Outdoor Air High-volume Sampling**	**Activity-Based Outdoor Air Personal Sampling**	**Fixed Ambient Reference Air Sampling**	**Soil Sampling**
Primary Method	ISO 10312, *Ambient air–Determination of asbestos fibres–Direct-transfer transmission electron microscopy method*	ISO 10312, *Ambient air–Determination of asbestos fibres–Direct-transfer transmission electron microscopy method*	ISO 10312, *Ambient air–Determination of asbestos fibres–Direct-transfer transmission electron microscopy method*	NIOSH 9002 *Asbestos (bulk) by PLM* (with sample preparation method using modified *U.S. EPA Region 8 SOP)*
Secondary Method	ISO 13794, *Ambient air–Determination of asbestos fibres–Indirect-transfer transmission electron microscopy method*	ISO 13794, *Ambient air–Determination of asbestos fibres–Indirect-transfer transmission electron microscopy method*	ISO 13794, *Ambient air–Determination of asbestos fibres–Indirect-transfer transmission electron microscopy method*	EPA 600/R-93/116 *Method for the Determination of Asbestos in Bulk Building Materials*
Sample Container	Open-faced cassette with a 25 millimeter diameter, mixed cellulose ester filter with pore size less than or equal to 0.80 :m	Open-faced cassette with a 25 millimeter diameter, mixed cellulose ester filter with pore size less than or equal to 0.80 :m	Open-faced cassette with a 25 millimeter diameter, mixed cellulose ester filter with pore size less than or equal to 0.80 :m	1 quart poly-propylene bags
Field Samples	142	136	74	130
Co-located Field Samples	15 (10% of field samples)	14 (10% of field samples)	8 (10% of field samples)	13 (10% of field samples)
Field Blanks	14 (2 per day)		2	none
Filter Blanks	7 (1 per day)		2	none
PE Samples	1			1
Total Samples	164	165	86	144

All 6-hour scenario-composite samples will be designated as requiring immediate analysis following ISO 10312, *Ambient air–Determination of asbestos fibres–Direct-transfer transmission electron microscopy method*, to determine the asbestos fiber and structure concentrations. The analytical sensitivity is discussed in Appendix F.

Other activity-based samples may be identified as needing immediate analysis or may be prioritized for analysis by the U.S. EPA Task Monitor. Prioritization will include order of analysis, and could include a decision not to analyze one or more samples, or to change the analytical sensitivity requirements.

Any collected sample that has an excessive concentration of dust (i.e., the sample is overloaded) may require analysis following ISO 13794, *Ambient air–Determination of asbestos fibres–Indirect-transfer transmission electron microscopy method*, instead of ISO 10312. Upon determination that asbestos fibers in a collected sample cannot be determined by the direct-transfer method, the laboratory will notify the START Technical Coordinator. The START Technical Coordinator will immediately notify the START Project Manager, who will notify the U.S. EPA Task Monitor. The U.S. EPA Task Monitor will determine and specify which samples will be determined by ISO 13794 prior to any analysis.

2.3.2 Fixed Ambient Reference Air Analytical Methods Requirements

Fixed ambient reference air samples will be submitted to the laboratory within five days of collection of the last sample. Samples will be analyzed to determine asbestos structures and fibers concentrations by TEM analysis. The analysis will determine and report regulated and potentially toxic non-regulated asbestiforms (e.g., so-called "Libby amphiboles"). Reporting shall include concentration and 95 percent confidence interval for the following data:

- Total structures per cubic centimeter (cc);
- Structure counts with length greater than 5 µm and having at least 3:1 aspect ratio;
- Structure counts with length greater than 5 µm but less than or equal to 10 µm and having a diameter less than or equal to 0.5 µm; and
- Structure counts with length greater 10 µm and having a diameter less than or equal to 0.5 µm.

All 8-hour fixed ambient reference air composite samples will be designated as requiring analysis following ISO 10312, *Ambient air–Determination of asbestos fibres–Direct-transfer transmission electron microscopy method*, in order to determine the asbestos fiber and structure concentrations. The analytical sensitivity is discussed in Appendix F.

2.3.3 Soil Analytical Methods Requirements

All soil samples will be held for shipment to the preparation laboratory pending a decision by the U.S. EPA Task Monitor to analyze them. Prior to analysis, the preparation laboratory will prepare all surface soil samples following procedures presented in Appendix D. These soil preparation procedures were developed for this project based on the standardized soil preparation method (ISSI-LIBBY-01 Revision 8, May 6, 2004) that was developed by U.S. EPA Region 8.

Upon receipt of the soil samples from the soil preparation laboratory, the analysis laboratory will analyze them to determine asbestos concentration in area percent by PLM analysis following NIOSH 9002 Asbestos (bulk) by PLM. Samples with asbestos concentrations that are below 1 percent by area will be analyzed further by TEM following EPA 600/R-93/116, *Method for the Determination of Asbestos in Bulk Building Materials*.

2.4 Quality Control Requirements

The quality control requirements in place for this project are divided into field quality controls and laboratory quality controls and are discussed below.

Field Quality Control

Field quality control is centered on procedures, checks and controls. All field data collection activities will follow strict procedures with START Project Manager oversight. All major deviations from established field quality control procedures will be approved by the U.S. EPA Task Monitor prior to implementation, and they will be documented. All minor deviations will be documented and reviewed by the U.S. EPA Task Monitor on a daily basis.

Air sampling equipment will be calibrated prior to sampling and checked and documented after sampling. Calibration information will be documented during initial calibration. Calibration and documentation ensures that designed flow rates are used for sampling and that actual sampling pump rates are used in flow calculations. The final calibration checks also ensure that the flow rates did not deviate beyond acceptable QC tolerances. Flow rate QC ranges are presented in Table 2-2. Sampling pumps that cannot be adjusted to the correct flow rate will not be used. Sampling pumps that demonstrate a problem maintaining set flow rates will not be used.

All dust monitoring instruments to be used are factory-calibrated. A self-test of the monitoring instrument will be run and documented daily. A zero calibration will be performed and documented daily prior to use of dust monitoring instrument. Any instrument that fails the self-test or zero calibration will not be used.

Air sampling pumps and dust monitoring instruments will be checked while in field use to ensure that the equipment is not failing. One source of sampler failure is from back-pressure increases due to sample loading. Increased back-pressure can cause excessive flow rate changes that may initiate a pump shut-down. Shut-downs of this kind will allow the collected sample to be used provided the flow rate change does not exceed QC limits, as presented in Table 2-2. Sampling pumps and monitors will be checked every 20 to 30 minutes during activity-based sampling. Fixed 24-hour ambient air and dust monitors will be checked every 8 to 24 hours. All instrument checks will be documented, and the START Project Manager or designee will review them daily.

Table 2-2
Sampling Pump QC Objectives and Recovery Limits

Sampling Pump	Nominal Flow Rate (liters per minute)	Flow Rate Control Limits		
		Acceptance Range (liters per minute)	Qualification Range (liters per minute)	Failure Rejection Range (liters per minute)
Fixed and Stationary High-flow samplers	10	9-11	7.5-9 11-12.5	<7.5 >12.5 (>±25%)
Personal Low-flow samplers	2.5	2.25-2.75	1.9-2.25 2.75-3.1	<1.9 >3.1 (>±25%)

**Table 2-3:
Routine Field Sampling Equipment/Instrument Maintenance**

Equipment/ Instrument	Pre-Sampling Maintenance	Field Maintenance/ Frequency	Corrective Actions
Leased High-flow Samplers	Leased samplers are maintained and certified by Lessor as being recently calibrated and in operational condition. Samplers are checked upon receipt from Lessor.	Sampler flow rates are set prior to every use, checked during use, and have a final check prior to sample handling. Samplers are wiped down between each monitoring location and before re-use. Instruments will be charged nightly.	START will have five redundant high-flow samplers on site throughout project. Samplers with any problem will be returned to Lessor for replacement.
U.S. EPA-Owned High-flow Samplers	U.S. EPA-owned equipment is maintained and certified by U.S. EPA Equipment Management facility as being recently calibrated and in operational condition. Samplers are checked upon receipt from U.S. EPA Equipment Management facility.	Sampler flow rates are set prior to every use, checked during use, and have a final check prior to sample handling. Samplers are wiped down between each monitoring location and before re-use. Instruments will be charged nightly.	START will have five redundant high-flow samplers on site throughout project. Samplers with any problem will be returned to the U.S. EPA Equipment Management facility for replacement.
Leased Low-flow Samplers	Leased samplers are maintained and certified by Lessor as being recently calibrated and in operational condition. Samplers are checked upon receipt from Lessor.	Sampler flow rates are set prior to every use, checked during use, and have a final check prior to sample handling. Samplers are wiped down between each monitoring location and before re-use. Instruments will be charged nightly.	START will have five redundant low-flow samplers on site throughout project. Samplers with any problem will be returned to Lessor for replacement.
U.S. EPA-Owned Low-flow Samplers	U.S. EPA-owned equipment is maintained and certified by U.S. EPA Equipment Management facility as being recently calibrated and in operational condition. Samplers are checked upon receipt from U.S. EPA Equipment Management facility.	Sampler flow rates are set prior to every use, checked during use, and have a final check prior to sample handling. Samplers are wiped down between each monitoring location and before re-use. Instruments will be charged nightly.	START will have five redundant low-flow samplers on site throughout project. Samplers with any problem will be returned to the U.S. EPA Equipment Management facility for replacement.
Leased Ambient Particulate Monitor	Instruments are maintained and certified by Lessor as being recently calibrated and in operational condition. Instruments are checked upon receipt from Lessor.	Self-check and zero calibration are performed daily prior to use. Samplers are wiped down between each monitoring location and before re-use. Instruments will be charged nightly.	START will have one redundant dust monitor on site throughout project. Instrument with any problem will be returned to Lessor for replacement.

Table 2-3:
Routine Field Sampling Equipment/Instrument Maintenance

Equipment/ Instrument	Pre-Sampling Maintenance	Field Maintenance/ Frequency	Corrective Actions
U.S. EPA-Owned Ambient Particulate Monitor	U.S. EPA-owned instruments are maintained and certified by U.S. EPA Equipment Management facility as being recently calibrated and in operational condition. Instruments are checked upon receipt from Lessor.	Self-check and zero calibration are performed daily prior to use. Samplers are wiped down between each monitoring location and before re-use. Instruments will be charged nightly.	START will have one redundant dust monitor on site throughout project. Instrument with any problem will be returned to U.S. EPA Equipment Management facility for replacement.
Leased Meteorological Station	Station is maintained and certified by Lessor as being recently calibrated and in operational condition. Station will be checked upon initial installation.	Station information will be checked on sampling days against meteorological observations and local meteorological information.	Weather station will be repaired in the field if possible. Otherwise station with a problem will be returned to Lessor and replaced by an alternate.
U.S. EPA-Owned Meteorological Station	U.S. EPA-owned instruments are maintained and certified by U.S. EPA Equipment Management facility as being recently calibrated and in operational condition. Station will be checked upon initial installation.	Station information will be checked on sampling days against meteorological observations and local meteorological information.	Weather station will be repaired in the field if possible. Otherwise station with a problem will be returned to U.S. EPA Equipment Management facility and replaced by an alternate.
Field Data Management	Field data management computers and printer(s) are maintained by E & E's Information Technology Team to ensure they are in operational condition for project use. Field data management PDA and software are maintained by U.S. EPA ERT for project use.	All database data will be backed up with hard copy data. Electronic files will be copied and saved on secondary media daily.	Computer and printer(s) will be replaced immediately if failure occurs. Databases will be re-initiated with backed up data.
Video and Photographic Documentation Equipment	Video and photographic equipment is maintained by E & E to ensure it is in operational condition for project use.	All video and photographic data will be stored on media and secured as data. All media will be backed up at the completion of field work.	Video and photographic equipment will be replaced immediately if failure occurs. Databases will be re-initiated with backed up data.

Laboratory Quality Control
Laboratory quality control is centered on analytical methods, procedures, inter-laboratory performance checks, replicate analysis and duplicate analysis. All laboratory analysis will follow procedures and standard analytical methods designated by the U.S. EPA for use on this project. Any major deviations will be approved by the U.S. EPA prior to implementation, and they will be documented. All minor deviations will be documented and approved by laboratory management prior to reporting. Laboratory management will monitor analyst's performance checks, replicate analyses, and duplicate analyses to ensure that the criteria are within limits specified in the analytical SOW. Laboratory QC limits are indicated in Table 1-1 and in the analytical SOW (Appendix E).

2.5 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

All instruments and equipment used during sampling and analysis will be serviced and maintained only by qualified personnel in accordance with the manufacturer's guidelines and recommendations. Routine equipment maintenance and calibration of field equipment to be used for the project are summarized in Table 2-3. Routine laboratory instrument maintenance for the methods to be used for the project are addressed in the analysis laboratory's QA Manual.

2.6 Instrument Calibration and Frequency

All instruments and equipment used during sampling and analysis will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations. The guidelines are summarized in Table 2-3. Analytical instrument calibration guidelines for the methods to be used for the project are addressed in the analytical method and the analysis laboratory's QA Manual.

2.7 Inspection/Acceptance Requirement for Supplies and Consumables

Appropriate field- and laboratory-required supplies and consumables to be used for this project are specified in the sampling and analytical methods (see the FSP or SOWs). Field materials used to collect samples will be of sufficient quality and material for the type of sampling (see section on sampling apparatus requirements in the FSP). Laboratory materials including standard reagents and chemicals and reference standards will be traceable from commercial suppliers with appropriate documentation. Proper documentation will be maintained by the laboratory as described in the laboratory QA manual. The laboratory QA manual describes the handling and disposal of laboratory-generated wastes, and the FSP describes the disposal of investigative-derived wastes.

2.8 Data Acquisition Requirements (Non-Direct Measurement)

Samples will be collected and logged on a chain-of-custody form as discussed in each task-specific FSP. Sampling information will also be described in the logbook. Samples will be kept secure in the custody of the sampling team members at all times. Samples will be transferred to the sample preparation laboratory and analytical laboratories via a commercial carrier in a properly custody-sealed container with chain-of-custody documentation. The commercial carrier's custody of samples will be documented with an air waybill or a bill of lading. The laboratories will note any evidence of tampering upon receipt.

For samples analyzed by analytical laboratories, the completed laboratory data reports and data packages will be submitted by the laboratories to the START QA Coordinator, who will arrange for the third-party validation of the data. The data validator will provide validated data summary reports to the START Project Manager.

2.9 Data Management

The START will utilize the Scribe software developed by the U.S. EPA to manage the project data. Laboratory data generated for this project will be provided to the START by the laboratory in both hard-copy and electronic format. The data will be reviewed and summarized in tables by START in the final report to the U.S. EPA Task Monitor. Copies of the full laboratory data summary forms will be provided to the U.S. EPA as an appendix to the final report, or earlier upon request. Field data that are entered into the Scribe database management program also will be presented to the U.S. EPA. These analytical and project data will be coupled with Global Positioning System (GPS) and Geographical Information System (GIS) data as needed prior to final reporting.

3 Assessment and Oversight

The QAPP activities described in this section will be conducted under the direction and approval of the U.S. EPA.

3.1 Assessments and Response Actions

General assessment procedures and response actions for the overall El Dorado Hills Naturally Occurring Asbestos Multimedia Exposure Assessment will follow the guidelines discussed in the U.S. EPA Region 9 Quality Management Plan (QMP) and the START QMP. Specific E & E assessment activities applicable to this project include peer review, technical systems audit, performance evaluation, and data quality assessment. Procedures for assessment and audit of data quality are described in Section 4 of this QAPP.

Peer Review

The E & E Project Manager will be responsible for assigning peer reviewers, schedules, and requirements for all stages of the project. Project deliverables to be peer reviewed include the QAPP, FSP, draft and final reports, and other technical memoranda. Technical documents will be peer-reviewed by appropriate senior level specialists and/or manager. The publications staff will be responsible for editing and report formatting.

Project deliverables will be peer-reviewed prior to release to the U.S. EPA. In time-critical situations, the peer-review process may be concurrent with the release of a draft to the U.S. EPA. Errors discovered during the peer-review process will be reported by the reviewer to the originator of the document, who will be responsible for corrective action.

The START QA Coordinator will review project documentation (logbooks, chain-of-custody records, etc.) to ensure the QAPP and FSPs were followed and that sampling activities were adequately documented. The QA Coordinator will document deficiencies and the START Project Manager will be responsible for corrective action.

Technical Systems Audit

Systems audits may be a part of the overall QA program for this project. Field and laboratory audits may be performed, as determined by the START Project Manager. For field audits, a designated START member independent of the sampling team will be responsible for overseeing field activities and ensuring that the QAPP and FSPs are implemented. For laboratory audits, the U.S. EPA QAO or an independent third party will be responsible conducting laboratory audits. The laboratory audits are not intended to document or measure performance, rather they will be used to document whether the laboratory is following good laboratory practices (GLP) and project-related procedures and protocols.

Non-conforming conditions in the field will be corrected immediately to the extent possible and as determined by the field QA team member, then documented in the field logbook. A technical memorandum to the START Project Manager will serve as notification to management staff and the U.S. EPA that corrective action was implemented and its effectiveness verified. Non-conforming conditions in the laboratory will be documented in an audit report. The START Project QA Coordinator will review the data with the START Project Manager, the U.S. EPA QAO and the U.S. EPA Task Monitor to determine if conditions are likely to affect the generated data and to determine the appropriate qualification of associated data, if any.

Performance Evaluation
In addition to external audits by the NVLAP or other state and federal certification programs, each subcontracted laboratory will analyze PE samples with field samples submitted by the START. PE analyses will be performed once during the sampling period to document performance. Performance data will be submitted to the U.S. EPA Task Monitor and QAO. While no PE sample is available for the soil matrix, the soil analytical laboratory will be given a PE sample as an air filter.

U.S. EPA Assessment Activities
The U.S. EPA has not identified to the START any U.S. EPA assessment activities to be performed independent of START, which can include surveillance, management system reviews, readiness reviews, technical system audits, performance evaluation, and audits and assessments of data quality.

3.2 Reports to Management

Specific memoranda and reports to be prepared for management include the following:

- **Monthly Status Reports** - The START Project Manager will prepare monthly status reports for the U.S. EPA describing activities on the project. They will summarize significant activities, problems, and corrective actions/recommended solutions.

- **Quality Assurance Project Plans and Field Sampling Plans** - The START Project Manager will prepare a QAPP and FSPs and submit them to the U.S. EPA Task Monitor for approval prior to commencing any field sampling activities.

- **Laboratory Report** - The analytical laboratories will generate preliminary and final data reports, which will be submitted to the START Project Manager. Copies of the reports or summaries of the data will be prepared as requested by the U.S. EPA Task Monitor.

- **Data Packages** - The laboratory data package shall include all original documentation generated in support of this project. In addition, the laboratory shall provide original documentation to support that all requirements of the methods have been met. This includes, but is not limited to, sample tags, custody records, shipping information, sample preparation/extraction records, and instrument printouts such as mass spectra. Copies of information and documentation required in this document are acceptable. Deliverables for this project must meet the guidelines in *Laboratory Documentation Requirements for Data Evaluation* (R9/QA/004.1), EPA Region 9, March 2001.

- **Data Validation Memorandum -** A qualified third-party data reviewer will review laboratory reported data and documentation and prepare a Data Validation Memorandum. The Data Validation Memorandum will be delivered to the START Project Manager and will assess completeness of data and identify potential quality issues that could impact the usability of the data. Based on the review and Data Validation Memorandum, appropriate data qualifiers will be added to individual data points as described in Section 4.

- **Final Report -** The START Project Manager will prepare a final report, which will include a summary of project activities and all final validated data.

4 Data Validation and Usability

4.1 Data Review, Validation, and Verification Requirements

All data generated will be reviewed internally by the laboratory QA manager as part of the laboratory's standard QA/QC procedures. The data also will be reviewed externally by both the U.S. EPA QAO and the START QA Coordinator. Raw analytical data reports and QC results will be compared to the project's stated accuracy, precision, and other QC requirements listed in each method SOW and summarized in this QAPP.

All laboratory-generated data will be reviewed, validated, and verified according to the laboratory's internal QA/QC procedures and method-specific standard operating procedures. A QC Summary Report shall be approved by the appropriate laboratory supervisor or manager and submitted with the raw analytical data to the START Project Manager. Laboratory data packages will conform to U.S. EPA Contract Laboratory Program (CLP)-equivalent formats, electronically and in hard copy.

Upon receipt of the data packages, the START QA subcontractor will fully validate the data and methods according to *USEPA CLP National Functional Guidelines for Organic and Inorganic Data Review*, USEPA 540R-94/012 and USEPA 540R-94/013, February 1994, and the QC criteria listed in the SOWs. Each method-specific SOW provides the minimum requirements to be met to establish the reliability of the modified methods. All data will be reviewed and validated.

4.2 Validation and Verification Methods

The procedures described in the above-cited U.S. EPA CLP functional guidelines and/or modifications will be used to validate the data packages. During the data review process, the data validator will resolve issues and request additional documentation as needed. Upon completion of the review the data validator will complete a Data Validation Memorandum, which will be used to describe data deficiencies and indicate any qualified data.

4.3 Reconciliation with User Requirements

After the Data Validation Memorandum has been completed START will evaluate the overall compliance with the project data quality indicator goals for precision, accuracy, representativeness, comparability, and completeness for the draft and final reports. The end users may perform statistical evaluations to determine confidence levels, along with a subjective evaluation of the data qualifiers, which will determine any bias or skewing of the results and usability of the data for the overall project.

If the validated data are determined to be not usable for the project or the data are found to have deviated significantly from the data quality indicator goals, its impacts will be discussed in the report. If critical data points are affected that impact the ability to complete the project objectives, the data users will report these findings immediately to the START Project Manager and the U.S. EPA Task Monitor to discuss potential corrective actions.

Reconciliation of Data with DQOs
Assessment of data quality is an ongoing activity throughout all phases of the project. The following outlines the methods to be used by the START for evaluating the results obtained from the project.

- Review of the DQO outputs and the sampling design will be conducted by the START QA Coordinator (and in some cases the U.S. EPA QAO) prior to sampling activities. The reviewer will submit comments to the START Project Manager for action, comment, or clarification. This process will be iterative.

- A preliminary data review will be conducted by the START. The purpose of this review is to look for problems or anomalies in the implementation of the sample collection and analysis procedures and to examine QC data for information to verify assumptions underlying the DQOs and the QAPP. When appropriate to the sample design, basic statistical quantities will be calculated, and the data will be graphically presented.

- When appropriate to the sample design and if specifically requested by the U.S. EPA Task Monitor, the START will select a statistical hypothesis test and identify assumptions underlying the test.

- When appropriate to the sample design and if specifically requested by the U.S. EPA Task Monitor, the START will examine the underlying assumptions of the statistical hypothesis test in light of the environmental data. This will be accomplished by determining the approach for verifying assumptions, performing tests for the assumptions, and determining corrective actions.

5 References

Asbestos Task Force (El Dorado County), *Findings and Recommendations on Naturally-Occurring Asbestos to El Dorado County*, March 11, 1999.

U.S. EPA, *Data Quality Objectives Process for Hazardous Waste Site Investigations,* EPA QA/G-4HW, EPA/600/R-00/007, Washington D.C., January 2000.

U.S. EPA, *Guidance for Quality Assurance Project Plans*, EPA QA/G-5, EPA/240/R-02/009, Washington, D.C., December 2002.

U.S. EPA, *Guidance for the Data Quality Objectives Process*, EPA QA/G-4, EPA/600/R-96/055, Washington D.C., August 2000.

U.S. EPA, *Guidance on Choosing a Sampling Design for Environmental Data Collection*, EPA QA/G-5S, EPA/240/R-02/005, Washington D.C., December 2002.

U.S. EPA, *Requirements for Quality Assurance Project Plans,* EPA QA/R-5, EPA/240/B-01/003, Washington D.C., March 2001.

Appendix A

Data Quality Objectives

Appendix B

Field Sampling Plans

Appendix C

Health and Safety Plan

Appendix D

Standard Operating Procedures

Appendix E

Analytical Scopes of Work

Appendix F

Reference Levels and Analytical Sensitivity